We claim:

1. A compound of the formula

$$R\text{-}X_1\text{-}Phe\text{-}Gly\text{-}X_2\text{-}NH_2$$

wherein X_1 is selected from the group consisting of Asn, Asp, Gly, Ser, and Ala, and X_2 is selected from the group consisting of Leu and Ile, and R is selected from the group consisting of:

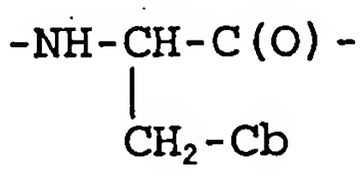
(a) $Cb\text{-}(CH_2)_n\text{-}C(O)\text{-}X_3'\text{-}$

wherein

(I) Cb is a carborane,

(ii) n is 1, 2, or 3, and

(iii) X_3' is selected from the group consisting of a bond, Tyr, Phe, and carboranyl alanine, said carboranyl alanine having the structure:



(b) $R_1\text{-}L_m\text{-}X_4\text{-}R_2\text{-}X_3\text{-}$

wherein

(I) X_4 is selected from the group consisting of a bond and Arg,

(ii) R_1 is a hydrophobic moiety selected from the group consisting of aromatic containing amine groups, aromatic containing acyl groups, and aliphatic fatty acyl groups, said hydrophobic moiety being effective to render said compound amphiphilic,

(ii) m is 0 or 1,

(iii) L is a spacer which, when R_1 is an aromatic containing acyl group or aliphatic fatty acyl group, said spacer is selected from the group consisting of non-polar hydrocarbon groups having an amino group and an acyl group, and uncharged α-amino acids, or when R_1 is an

aromatic containing amine group, said spacer is a diacyl group,

(iv) R_2 is selected from the group consisting of a bond, an amino acid, and a polypeptide group, said polypeptide group comprising all or a portion of an allatostatin neuropeptide which is naturally contiguous to the C terminal pentapeptide X_3-X_1-Phe-Gly-X_2-NH_2, and which said polypeptide group is sufficiently small as to retain the hydrophobicity of said compound introduced by said hydrophobic moiety, and

(v) X_3 is selected from the group consisting of Tyr, Phe, and carboranyl alanine; and

(c) R_3-carboranyl alanine-, wherein R_3 is selected from the group consisting of H and Arg.

2. The compound of claim 1 wherein R is said Cb-$(CH_2)_n$-C(O)-X_3'-.

3. The compound of claim 2 wherein said carborane is selected from the group consisting of *o*-carborane and *m*-carborane.

4. The compound of claim 1 wherein R is said R_1-L_m-X_4-R_2-X_3-.

5. The compound of claim 4 wherein R_2 is a bond.

6. The compound of claim 4 wherein R_2 is selected from the group consisting of:

-Leu-,

-Ala-Tyr-Ser-Tyr-Val-Ser-Glu-Tyr-Lys-Arg-Leu-Pro-Val-,

-Ser-Lys-Met-,

-Asp-Gly-Arg-Met-,

-Asp-Arg-Leu-,
-Ala-Arg-Pro-,
-Ala-Pro-Ser-Gly-Ala-Gln-Arg-Leu-,
-Gly-Gly-Ser-Leu-,
-Gly-Asp-Gly-Arg-Leu-,
-Pro-Val-Asn-Ser-Gly-Arg-Ser-Ser-Gly-Ser-Arg-,
-Tyr-Pro-Gln-Glu-His-Arg-, and
-Pro-.

7. The compound of claim 4 wherein R_1 is a hydrophobic aromatic containing acyl group, m is 1, and L is selected from the group consisting of non-polar hydrocarbon groups having a free amino group and free acyl group, and uncharged α-amino acids.

8. The compound of claim 7 wherein R_1 is selected from the group consisting of phenyl alkanoic acyl groups, phenyl alkenoic acyl groups, and phenyl alkynoic acyl groups.

9. The compound of claim 8 wherein R_1 is selected from the group consisting of a 9-fluoreneacetic acid group, a 6-phenyl hexanoic acyl group, and a 9-phenyl nonanoic acyl group.

10. The compound of claim 7 wherein L is selected from the group consisting of Ala, Ala-Ala, and Gly.

11. The compound of claim 4 wherein R_1 is a hydrophobic aromatic acid and m is 0.

12. The compound of claim 11 wherein R_1 is selected from the group consisting of phenyl alkanoic acyl groups,

phenyl alkenoic acyl groups, and phenyl alkynoic acyl groups.

13. The compound of claim 12 wherein R_1 is selected from the group consisting of a 9-fluoreneacetic acid group, a 6-phenyl hexanoic acyl group, and a 9-phenyl nonanoic acyl group.

14. A composition comprising the compound of claim 1 and an inert carrier.

15. The composition of claim 14 wherein said carrier is water.

16. A method for controlling insects comprising applying the compound of claim 1 to the locus of said insects.

17. The method of claim 16 wherein said insects are cockroaches.

18. The method of claim 16 wherein said applying comprises topically applying said compound onto said insects.

19. The method of claim 17 wherein said compound is applied in an amount effective to inhibit juvenile hormone production by said insect.

20. A compound of the formula:

$$R'\text{-}X_1\text{-}X_a\text{-}X_b\text{-}X_2\text{-}NH_2$$

wherein:

(a) R' is selected from the group consisting of Phe, Tyr, a hydrocinnamyl group, a *p*-

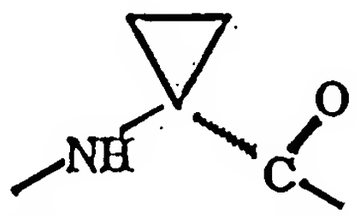
hydroxyhydrocinnamic acyl group, and a polypeptide group, which said polypeptide group comprises all or a portion of an allatostatin neuropeptide which is naturally contiguous to the C terminal tetrapeptide X_1-Phe-Gly-X_2-NH_2;

(b) X_1 is selected from the group consisting of Asn, Asp, Gly, Ser, and Ala;

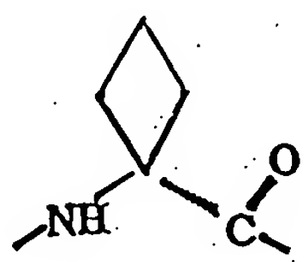
(c) X_2 is selected from the group consisting of Leu and Ile;

(d) X_a-X_b is selected from the group consisting of:

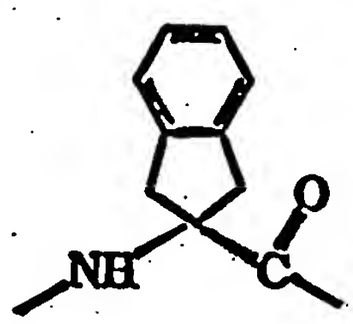
(I) -Phe-Caa- wherein Caa is a cycloalkyl alanine group selected from the group consisting of cylcopropyl alanine having the structure:



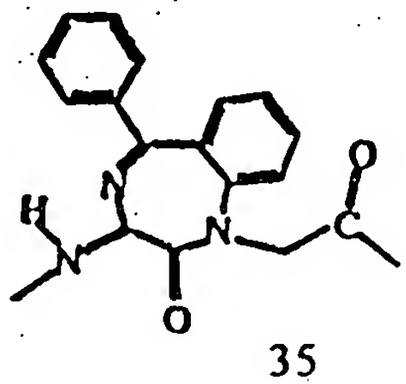
or cyclobutyl alanine having the structure:



(ii) -Aic-Gly- wherein Aic is a 2-amino-indane-2-carboxyl group having the structure:



(iii) -Bzd- wherein Bzd is a 1,4-benzodiazepine group having the structure:



and

(iv) -Aic-Caa-.

21. The compound of claim 20 wherein R' is Phe or Tyr.

22. The compound of claim 20 wherein R' is a hydrocinnamyl group or a hydroxycinnamyl group.

23. The compound of claim 20 wherein R' is selected from the group consisting of:

Leu-X_3-,

Ala-Tyr-Ser-Tyr-Val-Ser-Glu-Tyr-Lys-Arg-Leu-Pro-Val-X_3-,

Ser-Lys-Met-X_3-,

Asp-Gly-Arg-Met-X_3-,

Asp-Arg-Leu-X_3-,

Ala-Arg-Pro-X_3-,

Ala-Pro-Ser-Gly-Ala-Gln-Arg-Leu-X_3-,

Gly-Gly-Ser-Leu-X_3-,

Gly-Asp-Gly-Arg-Leu-X_3-,

Pro-Val-Asn-Ser-Gly-Arg-Ser-Ser-Gly-Ser-Arg-X_3-,

Tyr-Pro-Gln-Glu-His-Arg-X_3-, and

Pro-X_3-

wherein X_3 is Tyr or Phe.

24. The compound of claim 20 wherein X_a-X_b is said Phe-cycloalkyl alanine.

25. The compound of claim 22 wherein X_a-X_b is said Phe-cycloalkyl alanine.

26. The compound of claim 20 wherein X_a-X_b is said Aic-Gly.

27. The compound of claim 22 wherein X_a-X_b is said Aic-Gly.

28. The compound of claim 20 wherein X_a-X_b is said Aic-Caa.

29. The compound of claim 22 wherein X_a-X_b is said Aic-Caa.

30. The compound of claim 20 wherein X_a-X_b is said Bzd.

31. The compound of claim 22 wherein X_a-X_b is said Bzd.

32. A composition comprising the compound of claim 20 and an inert carrier.

33. The composition of claim 32 wherein said carrier is water.

34. A method for controlling insects comprising applying the compound of claim 20 to the locus of said insects.

35. The method of claim 34 wherein said insects are cockroaches.

36. The method of claim 34 wherein said compound is applied in an amount effective to inhibit juvenile hormone production by said insect.

37. A method for controlling insects comprising applying the compound of claim 30 to the locus of said

insects in an amount effective to stimulate juvenile hormone production by said insect.

38. A compound of the formula:

$$R\text{-}X_1\text{-}X_a\text{-}X_b\text{-}X_2\text{-}NH_2$$

wherein X_1 is selected from the group consisting of Asn, Asp, Gly, Ser, and Ala; X_2 is selected from the group consisting of Leu and Ile; R is selected from the group consisting of:

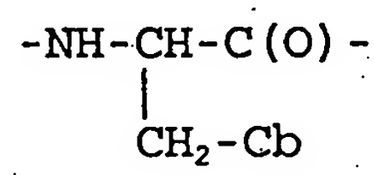
(a) $Cb\text{-}(CH_2)_n\text{-}C(O)\text{-}X_3'\text{-}$

wherein

(I) Cb is a carborane,

(ii) n is 1, 2, or 3, and

(iii) X_3' is selected from the group consisting of a bond, Tyr, Phe, and carboranyl alanine, said carboranyl alanine having the structure:



(b) $R_1\text{-}L_m\text{-}X_4\text{-}R_2\text{-}X_3\text{-}$

wherein

(I) X_4 is selected from the group consisting of a bond and Arg,

(ii) R_1 is a hydrophobic moiety selected from the group consisting of aromatic containing amine groups, aromatic containing acyl groups, and aliphatic fatty acyl groups, said hydrophobic moiety being effective to render said compound amphiphilic,

(ii) m is 0 or 1,

(iii) L is a spacer which, when R_1 is an aromatic containing acyl group or an aliphatic fatty acyl group, said spacer is selected from the group consisting of non-polar hydrocarbon

groups having an amino group and an acyl group, and uncharged α-amino acids, or when R_1 is an aromatic containing amine group, said spacer is a diacyl group,

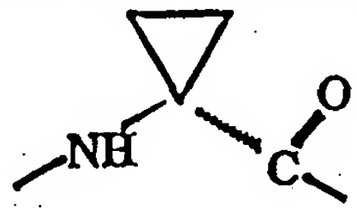
(iv) R_2 is selected from the group consisting of a bond, an amino acid, and a polypeptide group, said polypeptide group comprising all or a portion of an allatostatin neuropeptide which is naturally contiguous to the C terminal pentapeptide X_3-X_1-Phe-Gly-X_2-NH_2, and which said polypeptide group is sufficiently small as to retain the hydrophobicity of said compound introduced by said hydrophobic moiety, and

(v) X_3 is selected from the group consisting of Tyr, Phe, and carboranyl alanine; and

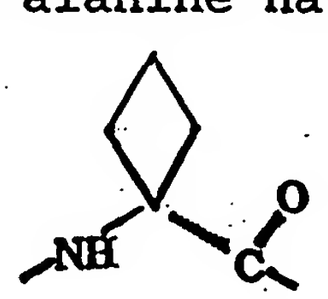
(c) R_3-carboranyl alanine-, wherein R_3 is selected from the group consisting of H and Arg;

and X_a-X_b is selected from the group consisting of:

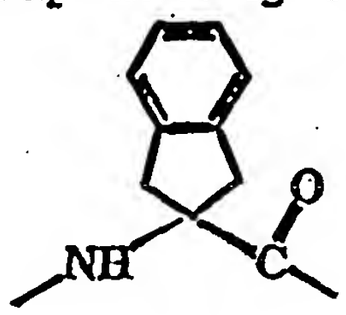
(a) -Phe-Caa- wherein Caa is a cycloalkyl alanine group selected from the group consisting of cylcopropyl alanine having the structure:



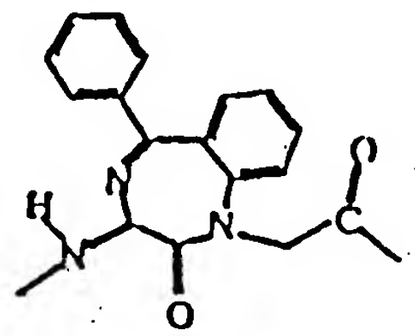
or cyclobutyl alanine having the structure:



(b) -Aic-Gly- wherein Aic is a 2-amino-indane-2-carboxyl group having the structure:



(c) -Bzd- wherein Bzd is a 1,4-benzodiazepine group having the structure:



and

(d) -Aic-Caa-.

39. A composition comprising the compound of claim 38 and an inert carrier.

40. A method for controlling insects comprising applying the compound of claim 38 to the locus of said insects.